

Remarks

A. Status of Application

Claims 11-21 were pending. Claim 11 has been amended. The amended claim is supported by the specification in at least FIGs. 1-6 and the associated description in the specification. Claims 11-21 will be pending upon entry of this paper.

Claims 11-21 were rejected under 35 U.S.C. §112, second paragraph. Claims 11-16 and 21 were rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,895,091 to Elliott et al. (hereinafter “Elliott ‘091”). Claims 17 and 18 were rejected under 35 U.S.C. §103(a) as being unpatentable over Elliott ‘091 in view of U.S. Patent No. 7,457,416 to Elliott (hereinafter “Elliott ‘416”), claim 19 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Elliott ‘091 in view of Menezes, et al, *Handbook of Applied Cryptography* (hereinafter “Menezes”), and claim 20 was rejected 35 U.S.C. §103(a) as being unpatentable over Elliott ‘091 in view of U.S. Patent No. 5,850,441 to Townsend et al. (hereinafter “Townsend”).

B. The Rejections Under 35 U.S.C. §102 are Overcome

Claims 11-16 and 21 were rejected under 35 U.S.C. § 102(e) as allegedly anticipated by Elliot ‘091. Applicant traverses this rejection.

Claim 11 reads:

11. A communication system using quantum cryptography comprising:
subscriber stations connected to one or more quantum channels;
one or more quantum-cryptographic device associated with the one or more quantum channels for generating a quantum key during use; and
two or more interconnected switching stations that, during use, communicate via **first public lines**, using encryption agreed upon, without quantum-cryptographic key exchange;
wherein, during use, the subscriber stations are connected to the switching stations via the one or more quantum channels that generate a respective temporary quantum key and are adapted to communicate via **second public lines** using the quantum key, and

wherein the first public lines are distinct from the second public lines, and are a priori secure lines to transmit the generated quantum key from one switching station to another and to another subscriber station.

Claim 11 (emphasis added).

Applicant disagrees with characterizations of the present claims and of the reference as found in the Action. Specifically, Applicant asserts that Elliot '091 fails to disclose every limitation of at least Claim 11. In particular, Elliot '091 fails to disclose "two or more interconnected switching stations that, during use, communicate via first public lines, using encryption agreed upon, without quantum-cryptographic key exchange." Additionally, Elliot '091 fails to disclose a communication system "wherein the first public lines are distinct from the second public lines, and are a priori secure lines to transmit the generated quantum key from one switching station to another and to another subscriber station" as recited in claim 11.

"Anticipation under 35 U.S.C. §102 requires the disclosure in a single piece of prior art of each and every limitation of a claimed invention." *Apple Computer, Inc. v. Articulate Systems, Inc.* 234 F.3d 14, 20, 57 USPQ2d 1057, 1061 (Fed. Cir. 2000). An anticipation under section 102 is proper only if the reference shows exactly what is claimed. *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 227 USPQ 773 (Fed. Cir. 1985). The Examiner has the burden of establishing a *prima facie* case of anticipation. *See In re Skinner*, 2 USPQ2d 1788, 1788-89 (B.P.A.I. 1986) (stating, "[i]t is by now well settled that the burden of establishing a *prima facie* case of anticipation resides with the Patent and Trademark Office.").

Elliot '091 describes a quantum cryptographic network (QC-network) 105 which includes a plurality of routers and hosts interconnected via links 552-578 which form single nodes in this network. *See* Elliot '091, Fig. 5. Some of the links 552-578 are protected by quantum cryptographic techniques (illustrated by solid lines in Fig. 5), while others are unprotected (illustrated by dashed lines in Fig. 5). Accordingly, for end-to-end message transmission between a source host 535 and a destination node according to Elliot '091 (e.g., description in connection with Figs. 17-20), the message to be sent is to be provided with a header which specifies both the required security level of the transmission and the address of the destination node. When a certain hop node receives the message, the destination address contained in the message header is compared with the address assigned to the hop node in order to determine if

the message has already reached its destination node. If not, the message is passed to the next hop node by means of a forwarding table 725 and QC-Interface (QCLI). The QC-Interface then exchanges quantum cryptographic keys with the next hop node. Col. 11, lines 4-13.

Elliott '091 nowhere disclose a communication system, where distinct first and second public lines interconnect switching stations and subscriber stations, respectively, wherein the first public lines are a priori secure public lines.

Elliott '091 merely teach a communication network having mixed quantum cryptographically secured lines and unprotected lines (illustrated by solid lines and dashed lines, respectively, in figure 5) for concatenating short communication distances hop node by hop node. As can be clearly seen from Fig.5 of Elliott '091, therein no distinction is made between first and second public lines. In particular, there is no direct connection between two hosts (cf. hosts 535, 540, 545, 550 in Fig. 5) via public lines distinct from quantum channels connecting the hosts to the routers and public lines interconnecting the routers. Also, nowhere from the specification or the figures can it be inferred that different types of public lines - a priori secure lines for interconnecting the routers and regular public lines for interconnecting the hosts - are contemplated.

By contrast, claim 11 describes “two or more interconnected switching stations that, during use, communicate via first public lines, **using encryption agreed upon, without quantum-cryptographic key exchange.**” Elliot '091 discloses a system where two or more interconnected routers communicate via quantum cryptographic lines by exchanging quantum cryptographic keys, but this system does not provide the advantages of a communication system “wherein the first public lines are distinct from the second public lines, and are a priori secure lines to transmit the generated quantum key from one switching station to another and to another subscriber station,” as described in claim 11. Therefore, Elliot '091 fails to disclose every element of claim 11, and the rejection under 35 U.S.C. § 102 is overcome.

Applicant asserts that dependent claims 12-21 are also allowable because of their dependence on allowable independent claim 11. *See In re Fine, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988).*

C. The Rejections Under 35 U.S.C. §103 are Overcome

1. Rejections of Claims 17 and 18 are Overcome

Claims 17 and 18 were rejected under 35 U.S.C. §103(a) as being unpatentable over Elliott '091 in view of Elliott '416. These rejections are overcome because claims 17 and 18 depend upon allowable claim 11. Nevertheless, Applicant traverses the rejections.

The Action asserts that "Elliott et al. discloses generating key bits between subscriber stations and their associated switching stations after a request for communication has been transmitted." Applicants respectfully disagree.

The Action acknowledges that Elliot '091 fails to disclose "generating a separate bit sequence and wherein, during use, a switching station associated with a called subscriber station generates a third key bit sequence from the key bit sequences generated via the quantum channels and transmits this third key bit sequence to the called subscriber station which, using the key bit sequence known to it and generated by it together with the associated switching station, from the third key bit sequence generates the key bit sequence generated on the part of the calling subscriber station, which then finally is used as a mutual key for the communication between the subscriber stations." *Id.* The Action asserts that "Elliot ['416] teaches such a quantum key agreement protocol" at Fig. 4 and col. 6, line 48 – col. 7, line 38. Applicant disagrees with this assertion.

"A *prima facie* case of obviousness may [] be rebutted by showing that the art, in any material respect, teaches away from the claimed invention." MPEP 2144.05(III) (quoting *In re Geisler*, 116 F.3d 1465, 1471 (Fed. Cir. 1997)).

The cited portion of Elliot '416 actually teaches away from claims 17 and 18 to the extent that they depend from claim 11. Specifically, Elliot '416 describes a system where endpoints each send QC keys to respective KDC devices. The KDC devices then exchange the QC keys and establish one of the exchanged keys as a common key. Col. 7, lines 1-32. Thus, Elliot '416 explicitly teaches away from claim 11 by teaching that switching devices should exchange quantum cryptographic keys, whereas claim 11 describes a system wherein "two or more interconnected switching stations that, during use, communicate via first public lines, **using encryption agreed upon, without quantum-cryptographic key exchange.**" Since claims 17 and 18 depend from claim 11, Elliot '416 also teaches away from claims 17 and 18. Moreover,

claim 17 relates to an exchange of key bit sequences between subscriber stations and switching stations, not exchange of key bit sequences from one switching station to another.

Therefore, Applicant asserts that independent claim 17 is patentable over the combination of Elliot '091 and Elliot '416 because the combination fails to teach or suggest all of the limitations of Claim 17 and because Elliot '416 explicitly teaches away from claim 11.

2. Rejection of Claim 19 is Overcome

Claim 19 was rejected under 35 U.S.C. §103(a) as being unpatentable over Elliott '091 in view of Menezes, et al. The rejection is overcome because claim 19 depends upon allowable claim 11. Nevertheless, Applicant traverses the rejections.

The Action acknowledges that "Elliot et al. fails to explicitly disclose discarding the quantum keys at the end of a communication." Nonetheless, the Office points to Menezes to support the rejection. Applicant disagrees with the Office's characterization of Menezes. More specifically, the cited portion of Menezes teaches cryptoperiods, long-term keys, and short-term keys. Menezes defines a "cryptoperiod" of a key as "the time period over which it is valid for use by legitimate parties." Menezes, at pg. 553. Similarly, "short-term keys" are described as keys "often used as data keys or *session keys* for a single communication session." By contrast, claim 19 recites a communication "wherein, during use, quantum keys generated for a given communication are discarded at the end of the communication." Thus, according to claim 19, the trigger for discarding the quantum keys is the "end of the communication" not the expiration of some arbitrary time period or termination of a full communication session as disclosed by Menezes. Thus, claim 19 is patentable over the combination of Elliot '091 and Menezes, because the combination fails to teach every element of claim 19.

Conclusion

In light of the presented remarks, Applicant assert that Claims 11-21, with the current amendments, are patentable and in condition for prompt allowance. Should additional information be required, the Examiner is respectfully asked to notify Applicants of such need. If any impediments to the prompt allowance of the claims can be resolved by a telephone interview, the Examiner is respectfully requested to contact the undersigned.

Respectfully submitted,



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